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THE

AIR FORCE IN SPACE

1969-1970

by

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FOREWORD

This study--the twelfth of a series of historical reports on The Air Force in Space--outlines plans and programs pursued during fiscal years 1969 and 1970. It chronicles developments in several major USAF programs--communication satellites, missile and space defense, space surveillance and the recently-authorized Space Shuttle. Where previous studies were published in two parts, the present narrative is in a single volume to better present the interrelationships of the various USAF space projects.

In June 1969, after nearly four years of effort and an expenditure of $1.3 billion, the Air Force's most complex and expensive space venture--the Manned Orbiting Laboratory (MOL)--was terminated. Deputy Secretary of Defense David Packard stated the action was taken primarily to reduce defense expenditures. However, he cited another reason for the cancellation--continuing U.S. "advances in automated techniques" for unmanned communication, navigation, and meteorology satellites. For special security reasons, coverage of the MOL project has not been included in this series. A separate history has been written and retired with the MOL records.

This study is based on the files and correspondence in the offices of the Directorates of Plans; Space; and Doctrine, Concepts, and Objectives; and the records of the Office of the Secretary of the Air Force. The writer also has consulted with various Air Staff and other defense officials.

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CONTENTS

I. THE AIR FORCE AND NASA

(U) In his final report to Congress in January 1969 on the nation's space programs, President Lyndon B. Johnson praised the 21-27 December 1968 flight of three Apollo astronauts, the first men in history to fly to and around the moon and return to earth. Commending the nation's investment in space, Mr. Johnson declared that it had brought the American people new products, services, and knowledge; enhanced national security; and stimulated the country's educational system. "I recommend," he said, "that America continue to pursue the challenge of space exploration."[1] Earlier, Mr. Johnson had decided that the incoming administration of President-elect Richard M. Nixon should determine its own space goals; therefore, in his final (fiscal year 1970) budget message to Congress on 15 January 1969, he requested $6 billion to support on-going programs, slightly less than the previous year's budget.[2]

(U) Mr. Nixon, meanwhile, had initiated a review of the nation's space programs. On 3 December 1968, following a* precedent established by John F. Kennedy eight years earlier, Mr. Nixon established a Task Force on Space to look into the matter and to submit recommendations to him. The Task Force was headed by Dr. Charles H. Townes, Nobel Prize winner and professor of physics at the University of California, and included among its members Dr. Robert C. Seamans, Jr., former Deputy Administrator of the National Aeronautics and Space Administration (NASA), soon to become Secretary of the Air Force. On 8 January 1969 the Task Force submitted its report to Mr. Nixon, recommending continuation of the current $6 billion effort but with greater emphasis on unmanned exploration of space.[3]

(U) Following his inauguration on 20 January, President Nixon launched a more extensive review of the nation's space activities. In February 1969 he established a Space Task Group

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*In December 1960 President-elect Kennedy established an ad hoc group under Dr. Jerome B. Wiesner, of the Massachusetts Institute of Technology (MIT), to review the space program established by President Dwight D. Eisenhower and to recommend changes.

(STG) to recommend a program and budget for the "post-Apollo period." Vice President Spiro T. Agnew chaired the group, which also included Secretary of Defense Melvin R. Laird, Acting NASA Administrator Dr. Thomas C. Paine, and the President's Science Advisor, Dr. Lee A. Dubridge. Mr. Nixon urged the STG to consult widely in formulating a national space program.[4]

(U) The Space Task Group submitted its report to the President on 15 September 1969. It proposed a "balanced" program designed to achieve these principal objectives:

Application of space technology to the direct benefit of mankind.

Operation of military space systems to enhance national defense.

Exploration of the solar system and beyond.

Development of new capabilities in space.

International participation and cooperation.

Borrowing a page from the recent Apollo landing on the moon,* the STG proposed a long-range United States commitment to land men on Mars sometime "before the end of this century." Like the lunar landing, the Mars mission would focus future space activities toward a definite target. However, because the mission lacked Apollo's urgency, the STG proposed proceeding in orderly stages so as not to upset other national priorities. "We stand at a crossroads, with many sets of missions and new developments open to us," the STG declared. A decision on which approach to follow depended upon "demands of other domestic programs, international conditions, and the state of economic health of our Nation." The STG did not recommend a space budget. Instead, it presented high, intermediate, and low funding options submitted by the Department of Defense (DOD) and NASA.[5]

*Apollo 11 put the first men on the moon on 20 July 1969.

[redacted]

(U) The military input to the STG--the "DOD Programs, Options, Recommendations" report--reflected a strong Air Force influence since Secretary of the Air Force Seamans represented Mr. Laird on the STG. Brig. Gen. Walter R. Hedrick, Air Force Director of Space, served as a senior staff delegate and presided over the steering committee which monitored the various DOD working groups.* All but one of these working groups were headed by Air Force personnel. Additionally, two Air Force bodies--the Scientific Advisory Board (SAB) and the Space Technology Advisory Group (STAG)--acted in a consultative role.[6]

[redacted] The DOD input to the Space Task Group represented the military's primary space objectives as: (1) information gathering; (2) deterrence; (3) limiting enemy damage to the nation; and (4) support of Allied forces. Corollary objectives included the maintenance of an "enhanced space technology base and bringing down the high cost of space operations.+ A host of space systems, contemplated to achieve the above objectives, were grouped into three general categories. Category I contained a broad range of existing systems--communications, surveillance, navigation, and so on. Justifiable in terms of demonstrated need, technological feasibility, and cost effectiveness, these space systems would be developed and made operational before 1985. Systems responsive to "significant technological or engineering advances, changes in national policy, or the emergence of new threats" were grouped under Category II. An example of this type was a deep space command post. The third category contained "undefined" systems such as a surface illuminator‡ or a weather modification system.[7]

[redacted] Initial drafts of the DOD report had provided only two funding options. Option A represented the upper limit of military space activities. Predicated upon the emergence of an unmistakably strong and provocative" Communist threat, Option A

*See Appendixes I and II for detailed assignments and membership.

+The high cost of space operations became the STG's most immediate concern. It is treated later in this chapter.

‡The idea of using reflectors on satellites to light up the ground at night. See Gerald T. Cantwell, The Air Force in Space, Fiscal Year 1966 (Off/AF Hist, Dec 1968), pp 46-47.

[redacted]

would provide a full array of military space capabilities. If approved, it would nearly double the existing $2 billion per year DOD space budget by fiscal year 1981. The lower funding limit, option B, sought to counter the "known and generally accepted projections of the Soviet and Chinese threat." This plan would raise space spending to almost $3 billion by 1974.[8]

[redacted] Dr. John S. Foster, Jr., Director of Defense Research and Engineering (DDR&E), viewed both alternatives as too ambitious. Backed by three Assistant Secretaries of Defense--Robert C. Moot (Comptroller), G. Warren Nutter (International Security Affairs), and Ivan Selin (Systems Analysis)--Foster led the dissent against the military recommendations. They asked Walter E. Morrow, Assistant Director of Lincoln Laboratory of MIT to determine if national security could be adequately protected by continuing with the existing military space budget. Submitted at the end of July 1969, the "Morrow Report" declared that no significant increase in space spending was necessary to meet DOD requirements and that an annual military space investment of about $2 billion would suffice through the 1970's.[9]

[redacted] Air Force officials objected to the Morrow report as too hastily prepared and insufficiently detailed to permit valid comparison with the DOD findings. They also cited the consensus of numerous studies which pointed to a rise in future space activities and a need for more space funds. Further, the Air Force contended that it was not committed to carry out the various programs described in its report to the STG. The DOD report would merely serve as a planning document with all programs subject to a "case-by-case" review.[10]

[redacted] To moderate the Air Force-ODDR&E differences, Deputy Secretary of Defense David Packard suggested a third funding option. Option C assumed a lessening of world tensions and was also "directly responsive to current national economic constraints." However, the Packard proposal--which called for expenditures of $2 and $2.4 billion annually--satisfied neither side. Dr. Foster and his supporters in the Office of the Secretary of Defense (OSD) considered even this level too high, while the Air Force cautioned that option C implied taking an unacceptable risk. A compromise was hammered out during August and incorporated into the final DOD report. The military space program would continue

near the $2 billion level, gradually rising to $2.25 billion in fiscal year 1975. Although Air Force officials still regarded option C as a risk, they conceded it would maintain an adequate space technology base.[11]

[redacted] Apparently convinced of the need to highlight military space priorities, Secretary Laird submitted the revised DOD report to the President in September 1969 as a supplement to the STG findings. The DOD report also described in greater detail a NASA-sponsored proposal to develop a national Space Transportation System (STS).[12]

The Space Transportation System

(U) The Space Task Group early recognized that the space program could not hope to compete effectively with other national priorities unless its operating expenses were substantially reduced. Thus, it cost $1,000 to deliver one pound of payload into low altitude earth orbit and 10 times as much to higher orbits. The high price of space operations stemmed largely from the fact that current U.S. launch vehicles* were not recoverable and therefore not reusable. Attention soon centered on the Space Transportation System concept. The system envisioned was a hypersonic transport originally intended for the maintenance and resupply of NASA's proposed orbiting space station. Featuring reusability, the STS held promise as a low-cost space launch vehicle. In March 1969 Vice President Agnew directed a joint DOD/NASA study of the STS.[13]

[redacted] Air Force interest in reusable spacecraft was not new. It dated back, at least, to the aerospace plane proposal of the early 1960's, which called for development of a horizontal take-off and landing recoverable vehicle having the ability to fly into low altitude orbits and return to earth. During 1961-1962 the Air Force initiated studies of its propulsion systems, but OSD reduced funding of the project. It did authorize the Air Force to

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*The U.S. space rocket inventory included the Scout, Thor, Atlas, Titan III, and Saturn "families." These were coupled with one of several corresponding upper stages such as the Agena, Burner II, Transtage, or Centaur.

proceed with a $2 million study of the advanced technology of what was designated a "Recoverable Orbital Launch System." The study, however, was held up by the Air Force pending further evaluation of its desirability. In June 1962 the Air Force Scientific Advisory Board (SAB)--after reviewing progress in related technology--concluded that the Air Force should focus its future efforts on a 2-stage concept. Two months later a joint USAF-NASA group--formed after the Air Force had sought the space agency's participation in the aerospace plane project--reached the same conclusion.[14]

[redacted] More recently the Air Force and NASA had undertaken separate lifting body* experiments and studied possible uses for the multipurpose reusable spacecraft (MRS). The MRS was considered for several military applications, notably: (1) routine and request surveillance;
(3) space rescue; and (4) launch and recovery of large payloads. These mission areas, however, had relatively low priority and were difficult to justify because of high projected development costs. On the other hand, the STS would be a "national" system with NASA sharing in the costs. Gen. John P. McConnell, Air Force Chief of Staff, believed the STS could be adapted to Air Force needs and proposed the Air Force assume responsibility for STS development. Secretary Seamans, too, was impressed with STS possibilities. However, he vetoed the proposal that the Air Force take charge of STS development, preferring to await additional study results. (The Air Force did not take a position on NASA's space station since it seemed to offer little military utility. Moreover, in a period demanding economic restraint the multi-billion dollar space station costs were certain to provoke political controversy.)[15]

(U) In April 1969 the Air Force and NASA established guidelines for the STS study. They agreed to explore technical and economic considerations for developing the system and to determine whether a single configuration could be devised to serve both their needs. After conducting independent researches, the Air Force and NASA submitted a coordinated report in June 1969.[16]

*Maneuverable reentry vehicles which derive their aerodynamic lift from the shape of their fuselages.

[redacted] Basically, the report concluded that STS development (1) would require no significant "breakthrough" in technology, (2) could achieve "a major reduction in the recurring costs of space operations," and (3) could meet the requirements of both agencies without "major technical penalty, development risk, limitation on mission flexibility, or cost increase." The report recommended a $52 million fiscal year 1970 allocation for preliminary design studies (Phase B). These would permit engineering development to begin the following year. Total STS program costs--through initial operational capability (IOC) in 1976--were estimated between $4 and $6 billion. These estimates assumed a traffic rate of 30 to 70 flights per year during the 1975 to 1985 period. With 100 reuses the STS would lower payload delivery costs to $50-$100 per pound to low altitude earth orbit and $500 per pound to high energy orbit.[17]

[redacted] In his study of the DOD report, Walter Morrow* had also examined the STS. He found the system's technical feasibility questionable and criticized the cost estimates. He noted that surface terminal support costs, which "together with their maintenance can greatly exceed the space segment costs" had been omitted. At best, Morrow predicted, the STS would save only $750 million over a 15-year period through 1985. He suggested the DOD postpone its participation in the system's development pending technical and economic analysis.[18]

(U) Air Force officials acknowledged the need for further experimental and theoretical study but opposed Morrow's proposal to defer participation in STS development. They noted that STS savings were considerably greater when viewed from the perspective of a national system. Further, the STS would provide much needed military capabilities. Finally, they cited Air Force and NASA studies in progress which would provide improved STS design, scheduling, and cost data in fiscal year 1971.[19]

[redacted] The proposed STS system would consist of a 2-stage vehicle--a booster and an orbiter--designed to launch and recover payloads to and from low earth orbit. Designated the earth-to-orbit shuttle (EOS), this portion of the system was better known as the Space Shuttle. In addition, the second stage would be

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*See p 4.

designed to later accommodate an orbit-to-orbit shuttle (OOS), or "space tug," permitting the transfer of payloads from low to high orbits. Military specifications for the Space Shuttle required a 50,000 pound payload capacity,* a payload volume of 10,000 cubic feet (or a compartment 15 feet in diameter by 60 feet long), and a crossrange--hypersonic lateral maneuvering--capability of 1,500 nautical miles.[20]

[redacted] Since NASA had lesser Shuttle payload and weight requirements, the Air Force saw the need to protect the military specifications from "the inevitable series of development tradeoffs. However, the Air Force's ability to influence system design was limited. It simply had little money and few personnel to spare for the project. As Under Secretary of the Air Force John L. McLucas told Secretary Packard, "with our other pressing needs, DOD cannot fund the development [of the Shuttle] as a whole." He, therefore, recommended DOD seek a "management relationship with NASA."[21]

[redacted] The space agency, meanwhile, pressed on. In August and September 1969, NASA officials narrowed the choice of Space Shuttle configurations to a fully reusable system. They further specified a smaller vehicle than had been agreed upon in the June 1969 study and left out the requirement for crossrange capability. When the Air Force protested this disregard of its specifications, Dr. George Mueller, Administrator for Manned Space Flight, defended the actions, saying they would provide a better correlation of study results. Nevertheless, recognizing the necessity for Air Force support,+ NASA relented. It subsequently invited Air Force participation in preparing technical specifications for industry and also agreed to incorporate Air Force proposals for an experimental program in the Shuttle's Phase B studies.[22]

(U) The Air Force, however, felt a formal arrangement between the two was needed and, on 7 November, Secretary Seamans proposed a joint policy review board be established.

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*Into a 100 nautical mile (NM) easterly orbit.

+As a joint agency effort, the Space Shuttle politically would be a more "viable" program.

Modeled on the Gemini program, this body would give the Air Force a voice in determining Space Shuttle requirements, technology, funding and management. NASA stalled on the proposal and sought to limit the Air Force role to passing on the system's technical requirements. The Air Force, continuing to insist on a "policy" role, on 17 February 1970 concluded an agreement with NASA which established the joint USAF/NASA STS Committee. The 8-member body with representation divided equally between the two agencies,* would continually review the Shuttle program and "recommend steps to achieve... DOD and NASA requirements."[23]

(U) While this action did not resolve all the Air Force-NASA differences, it provided the mechanism for reaching an agreement. In January 1970, Dr. Paine announced the space agency would incorporate the Air Force's requirements in requests for industry proposals, which were released in February. Contractor proposals were evaluated during May 1970 by a joint source evaluation board. In June, NASA awarded three Phase B contracts (valued at $6 million apiece) for the Shuttle main engine to Pratt & Whitney, Rocketdyne, and Aerojet. Two $8 million contracts were signed with North American Rockwell and McDonnell-Douglas for the Shuttle vehicle design. In addition, Grumman, Chrysler, and Lockheed were awarded contracts for alternative (Phase A) studies of a single stage to orbit vehicle, an expendable first stage, and solid auxiliary boosters. NASA's total fiscal year 1971 Space Shuttle effort would cost over $51 million.[24]

(U) Meanwhile, the STS Committee explored certain specific issues. Although the Air Force's financial contribution to the Space Shuttle effort was limited to $4 million in fiscal year 1971, it operated some outstanding laboratory facilities+ which NASA sought free use of. The Air Force, however, pointed out that

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*USAF members included Assistant Secretary of the Air Force (R&D) Grant L. Hansen, co-chairman, General Hedrick, Maj. Gen. Felix M. Rogers, Deputy Chief of Staff/Plans, Air Force Systems Command (AFSC), and Brig Gen. Raymond A. Gilbert, Director of Laboratories, AFSC. Their NASA counterparts were: Dale Myers, Deputy for Manned Space Flight; Vincent L. Johnson, Deputy Associate Administrator (Engineering); Lee B. James, Manager, Saturn Program Office; and Dr. Christopher C. Kraft, Jr., Director of Flight Operations. Former astronaut William A. Anders, Aerospace Council head, was invited as an observer.

+In technology areas of flight dynamics, propulsion, materials, structures, and thermal protection.

existing DOD directives required that such support be given on a cost reimbursable basis. NASA also asked for Air Force personnel support, including 10 officers at the Manned Spacecraft Center (MSC), five at the Marshall Space Flight (MSFC), two at Cape Kennedy, and five at NASA headquarters. The Air Force deferred a decision on this matter pending review, but did agree to locate five liaison personnel at both centers. The most important issue, however, revolved around Shuttle size and crossrange capability. Unless these specifications were included, Air Force officials maintained, they would be forced to abandon the Space Shuttle effort and concentrate on modifying existing space launch vehicles.[25]

Air Force Eastern Test Range

(U) Besides the Space Shuttle development, DOD and NASA had explored a broad field of common activities in an effort to reduce costs. In June 1968, Deputy Secretary of Defense Paul H. Nitze and NASA Administrator James Webb discussed potential savings through combining or reducing their respective space programs. A joint investigation was subsequently initiated under the aegis of the Aeronautics and Astronautics Coordinating Board (AACB). The military portion of the economy drive was assigned to DDR&E. In-depth studies of 12 major activities* were conducted during the fall of 1968 with most completed by the end of the year. Although some long-term savings were identified, only a few areas promised immediate cost reductions. Conclusions drawn from the study effort attested to the effectiveness of DOD-NASA cooperation and indicated that significant economies were not possible unless specific projects were curtailed or cancelled.[26]

[redacted] One of the studies--on the Eastern Test Range (ETR)--was of special interest to the Air Force, DOD manager of the range. With the steady decline in the number of major launches from the ETR (they dropped from 199 in 1961 to 52 in 1968), the range's future military utility came into question as operational and maintenance costs remained nearly constant--at some $200 million per year.[27]

[redacted] Nevertheless, Air Force officials favored retaining ETR management. First, they argued, the range

*For a resume of the economy studies see Appendix 3.

was indispensable for military launches because of its unique physical and geographic characteristics. Relocating ballistic missile test facilities and equipment was considered both impractical and costly. For the same reasons, space launches requiring synchronous or low inclination orbits could not be accomplished elsewhere. Second, the Air Force cited its record of adjusting to ever-changing support requirements as evidence of management know-how. Thus, for example, it had successfully cut the ETR contractor work force from 10,600 to 8,560 man-years annually between fiscal years 1966 and 1969. To meet DOD requirements, the Air Force proposed resizing the ETR and establishing improved cost reimbursement procedures* in support of NASA.[28]

[redacted] The Air Force position won acceptance in June 1969 when Deputy Secretary of Defense Packard approved resizing and reducing the ETR. The range would continue to support Navy fleet ballistic missile tests, Air Defense Command (ADC) and Joint Chiefs of Staff (JCS) surveillance activities, and Air Force space programs. Minuteman III R&D testing would be completed at the ETR, with its operational test series performed at the Western Test Range. However, on the complex issue of NASA reimbursement, Secretary Packard opposed any basic shift in policy because the existing arrangement permitted "economies accruing to the Federal Government." At any rate, the Air Force was confirmed as manager of the ETR and the economy study was closed out by the AACB in October 1969.[29]

[redacted] It did not remain closed for long. In February 1970, the Bureau of the Budget (BOB) pressed for a reexamination; it argued for a consolidation of the ETR with the Kennedy Space Center (KSC) under NASA management. DOD and space agency officials, however, opposed such action stressing the desirability of keeping the military and space programs separate. Also, in terms of cost reductions, the Air Force had made considerable progress. Thus, the 1960's decade had seen a drop in the number of instrumentation ships from eight to three, the deactivation of nine down-range tracking stations, and a cut in contractor man-years support to 7,954. By June 1970, the BOB was convinced to withdraw its proposal for an ETR/KSC consolidation.[30]

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*The reimbursement issue is discussed later in this chapter.

[redacted]

[redacted] While these events reaffirmed the need for an independent military launch capability at the ETR, continued Air Force management of the range was by no means assured. In April 1970, Dr. Foster noted that the overwhelming number of forecasted launches at the ETR during the next decade involved fleet ballistic missile tests. Since the Navy was to be the "dominant user" of the range, he reasoned, why not assign management to them? By the end of fiscal 1970, neither the Air Force nor the Navy had answered. The Air Force Systems Command, meanwhile, was preparing a rebuttal denying the validity of the dominant user concept. It cited the case of the White Sands Missile Range, N.M., where the Air Force generated the most activity, but the Army was manager. Another consideration involved the substantial management transfer costs. AFSC cited its experience in missile and space testing management; it argued there was no reason to believe that the Navy could do a better job. Finally, the resizing of the ETR was under way, promising further economies.[31]

The Reimbursement Issue

(U) Reimbursement by NASA for large-scale Air Force assistance at the Eastern Test Range first became an issue in 1963. At that time, OSD policy was to support NASA on a generally nonreimbursable basis. However, with projections of increased space activities, the Air Force--recalling its experience in the Mercury program--pressed for a policy revision. OSD gradually accepted the Air Force view. On 2 November 1966, Secretary of Defense Robert S. McNamara informed the space agency of his intent to recover full support costs. When, by April 1967, DOD-NASA negotiations had failed to produce an equitable cost-sharing arrangement, the issue was referred for arbitration to Mr. Charles S. Schultz, the BOB Director. In February 1968, the Bureau issued these guidelines: (1) DOD would bear all costs for management of the range with NASA responsible only for direct services and equipment; (2) DOD would pay 60 percent of the overall cost of operations (radar, telemetry, and communications) NASA, 40 percent; and (3) as per a prior agreement, Apollo support aircraft costs would be apportioned at 85 percent NASA, 15 percent DOD. The BOB guidelines were to be applicable only for fiscal year 1969, pending establishment of a more efficient cost accounting system by the Air Force.[32]

[redacted]

(U) Modeled on accrual accounting procedures* common in industry, the system was designed to settle DOD-NASA reimbursements once and for all. Implementation, however, proved more difficult than anticipated. By September 1968, the ETR system was still incomplete and its utility for the fiscal year 1970 budget had run out. As a result the BOB was again asked to adjudicate the reimbursement issue. It subsequently recommended extending the 1969 guidelines for another year.[33]

(U) Meanwhile, the Air Force sought a more definitive reimbursement policy. Despite OSD's decision to recover "full costs" for NASA support, disagreement existed over the term's meaning. Basically, the Air Force understood full cost to mean recoupment of all direct and indirect costs. NASA, on the other hand, believed it meant only additive or out-of-pocket expenses--the difference was considerable. For example, had the Air Force interpretation applied for fiscal year 1970, an extra $40 million might have been reimbursed. Moreover, unless the issue were settled in favor of the Air Force, the new cost accounting system would have to be redesigned. An adverse decision would also jeopardize plans to extend the system to all research and development (R&D) activities. Thus, the Air Force played down the problems experienced in perfecting the ETR system. Instead, it promoted a policy of recovering all identifiable costs in future agreements with NASA. The Air Force position was contained in a draft regulation widely circulated beginning in August 1969. Comptroller Moot agreed with the Air Force in principle, but insisted on continuing NASA range support on an additive basis. Until the ETR system was more fully refined, he reasoned, little would be gained from negotiating a new agreement.[34]

(U) Several other factors precluded adopting the Air Force position. First, the status of the Eastern Test Range/Kennedy Space Center (ETR/KSC) remained unclear. As noted above,

*By this method all direct and indirect charges were included in billing the customer. President Nixon directed all government agencies to convert to the accrual system by January 1971. However, it was generally recognized that the changeover could not be accomplished until about a year later. [Memo (U), President Nixon to Dir/BOB, et al, 22 Feb 69; memo (U), Sec of the Treasury, et al, to Heads of Depts and Agencies, 10 Mar 69.]

between February and June 1970 consideration was given to consolidating the complex. The transfer of ETR/KSC management to either NASA or the Navy also loomed as possibilities. Air Force officials soon discovered that the reimbursement issue could cut two ways. Hence, it would cost far less for the Air Force to participate in NASA's Space Shuttle development under an additive cost arrangement. A decrease in the overall NASA program--requiring a lower level of Air Force assistance--further diluted the significance of the reimbursement issue.[35] (This trend is depicted in the chart below.)

Air Force Support of NASA[36]

	Costs ($1,000's)			Man-Years	
	Non-Reimbursed +	Reimbursed =	Total Support	Non-Reimbursed	Reimbursed
FY 67	79,952.0	164,773.0	244,725.0	8,202.3	5,088.6
FY 68	44,618.7	116,287.8	160,906.5	4,710.5	4,029.0
FY 69	47,466.2	128,262.7	175,728.9	4,373.4	6,316.5
FY 70	23,450.6	101,797.4	125,248.0	2,554.6	3,486.0

Finally, by the end of June 1970, OSD was in the midst of negotiations with NASA to continue to pay out-of-the-pocket additive costs for use of the ETR and other ranges. Since this area represented some 90 percent of the Air Force's non-reimbursable funds, the full cost issue became a moot point. At least for the moment, the reimbursement issue was closed.[37]

Personnel Assigned to NASA

(U) The assignment of Air Force personnel to NASA constituted another area of mutual cooperation. Thus, NASA obtained a ready managerial and technical source, while the Air Force benefitted from the experience these officers gained working with the space agency. To bolster the Gemini and Apollo programs, the number of Air Force detailees grew from 65 to 224 between 1964 and 1967. The majority of the officers were assigned to the Manned Space Center in Houston, Tex. Faced with a shortage of qualified R&D officers, the Air Force balked at the increase. Also, their assignment primarily to manned space activities

would produce specialists already excess to Air Force needs. A USAF-NASA review of the situation in April 1967, led Lt. Gen. Joseph R. Holzapple, Deputy Chief of Staff for Research and Development, "to reduce and redistribute the personnel assigned to NASA." Although 32 spaces were eliminated at that time, further cuts were deferred for fear of upsetting the Apollo program.[38]

(U) In early 1969, with Project Apollo nearing a climax, the Air Force participated in another review. It disclosed that only 50 positions--comprising general officers, astronauts, and doctors--were indispensable to the space agency and could not be readily found on the civilian labor market. Earlier, an Air Force-wide survey revealed an annual requirement for about 30 officers with NASA experience. The Director of Space recommended these 80 positions be distributed among a cross-section of NASA activities according to the following scheme.[39]

Advanced research and technology	40%
Tracking and data acquisition	10%
Space science and applications	25%
Manned space flight	25%

On 5 September 1969, the Air Force advised NASA that it planned to phase out manned flight assistance entirely by mid-1972. The new policy permitted certain voluntary extensions. However, future personnel assignments* to NASA would be validated only when they could not be filled from civilian resources. Also, the positions would have to be mutually advantageous, their costs reimbursable, and not counted against the Air Force's manpower ceiling. At the end of fiscal year 1970, the number of Air Force detailees to NASA had dropped to 137.[40]

*Personnel assigned to support the Space Shuttle were excluded from this policy.

II. COMMUNICATION SATELLITES

[redacted] The military communication satellite network embraced two distinct but related programs. The Defense Satellite Communications System (DSCS) was designed for strategic use, such as between unified and specified commanders and the national command authorities. Comprised of small, low power satellites working in conjunction with large, fixed terminals, the DSCS provided global point-to-point communications. The Tactical Satellite Communications (TacSatCom) program was intended to furnish communications between lower echelon units. It employed larger, more powerful satellites operating with small, mobile terminals installed aboard aircraft, ships, and motor vehicles. The Air Force envisioned a future merger of the DSCS and TacSatCom into a single system.

DSCS

[redacted] Originally conceived as an R&D program, DSCS Phase I* was pressed into operation in July 1967 to meet the need for improved communications with Southeast Asia (SEA) forces. Managed by the Defense Communications Agency (DCA), DSCS was an interservice effort. The Air Force was responsible for the space segment, while the Army and Navy provided ground and shipborne terminals, respectively. Completed on 13 June 1968, the DSCS-I consisted of 26 satellites in near-synchronous (drifting) orbits around the equator and 36 terminals deployed worldwide. A communications link was established when a satellite came into mutual view of two terminals. The satellite network proved more effective than conventional radio and submarine cable communications and was exceeding its predicted 3-year lifetime. Nevertheless, DSCS-I was an interim arrangement with many deficiencies. The satellites for example, drifted at variable rates and sometimes bunched too closely together, causing gaps in worldwide coverage. Other shortcomings included low power, too few channels, insecure command and telemetry, and no protection against nuclear effects.

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*Earlier known as the Initial Defense Communications Satellite Program (IDCSP).

Moreover, to preclude interference with future systems, each satellite was preset to shut down after six years of operation. Thus, DSCS-I would have only limited utility during 1971 and fall completely silent by mid-1974.[1]

[redacted] On 17 June 1968 Deputy Secretary of Defense Nitze approved initiation of DSCS Phase II. Contemplated for service between 1971 and 1975, Phase II would correct its predecessor's major deficiencies. Hence, the four DSCS-II satellites would be placed into synchronous (fixed) orbits providing uninterrupted communications. Each satellite would have one broad beam antenna to provide for full earth coverage and two steerable narrow beam antennas to concentrate high power on select contingency areas. The satellites also featured secure command and data circuits, radiation-hardness, and better than a tenfold increase in communication channels.[2]

[redacted] The Air Force planned to launch a pair of DSCS-II satellites aboard a Titan IIIC rocket in February 1971, a second pair six months later, and retain two satellites as spares in case of failure or need to replenish the system. Space segment costs, were estimated at $120 million. For the ground system, the 36 Phase I terminals would be modified and 30 new terminals added at a projected cost of $139 million. A 15 percent ceiling was applied to the overall program. The Air Force preferred faster system acquisition and more ground terminals but, in view of the stringent budgetary situation, accepted the lesser approach.[3]

[redacted] Requests for proposal (RFP's) were issued to industry during October 1968; subsequently, on 3 March 1969 TRW Systems, Inc., was awarded the satellite contract. In July 1969 a preliminary design review disclosed the payload would be 71 pounds overweight, but design changes were made in the spacecraft which corrected the discrepancy. Another problem involved an Air Force requirement to command the satellites following a nuclear detonation. Since the TRW contract was indefinite on this specification, the Air Force met with the firm's representatives to clarify the requirement. An agreement on the work was reached which would delay the initial launch to March 1971 at no additional cost to the government.[4]

[redacted] Meanwhile, higher charges for boosters and launch services drove up program costs. Cancellation of the Manned

Orbiting Laboratory program* in June 1969 raised Titan IIIC costs about $5 million and the revised AFETR guidelines increased range support by some $3 million. Despite these developments, the space segment went generally as planned and Dr. Foster, DDR&E, praised the Air Force's program management. On the other hand, there were major setbacks in the ground systems acquisition effort. Poor management, serious technical problems, late deliveries, and soaring costs slipped the availability of new terminals from 1971 to 1973.[5]

[redacted] As a result, Deputy Secretary Packard revised the DSCS-II development plan in May 1970. He raised the space segment cost ceiling to $145 million plus five percent and rescheduled the initial satellite launch to May 1971. The ground system budget, also increased, was restricted to modifying 29 Phase I terminals. Secretary Packard approved continued development of new terminals, but deferred their procurement pending further review in April 1971. Meanwhile, he ordered a sweeping reassessment to define satellite systems and applications needed for the period through 1980. In a related action, Mr. Packard created the Office of Assistant to the Secretary of Defense for Telecommunications to facilitate and strengthen DSCS program management.[6]

[redacted] Another aspect of the DSCS involved Allied participation. In September 1966 the DOD agreed to procure and orbit two improved Phase I-type satellites for the United Kingdom (UK). A similar agreement was concluded with the North Atlantic Treaty Organization (NATO) in September 1968. The Air Force served as DOD agent in support of both programs. Two American firms, Philco-Ford and Radiation, Inc., developed the space and ground systems, respectively, and NASA provided the Thor/Delta boosters. All costs would be fully reimbursable.[7]

[redacted] Launched on 21 November 1969, the UK satellite (Skynet I) was later placed in synchronous orbit over the Indian Ocean and control transferred to the British. Skynet II, the in-orbit spare, was scheduled for launch in August 1970. Similarly, the NATO I satellite, launched on 20 March 1970, was subsequently positioned in synchronous orbit over the Atlantic Ocean and operational control+ turned over to NATO. The satellite spare, NATO II,

*See Foreword.

+The Air Force Satellite Control Facility (SCF) maintained orbital command and control.

was slated for a September 1970 launch. Both the Skynet and NATO projects were successful, although they had experienced delays due to technical difficulties with the spacecraft and terminals.[8]

[redacted] Meanwhile, attention focused on the extent and nature of future Allied involvement. A major concern related to the DSCS-II capacity. Although conceived in 1966 to accommodate Allied needs, the system had since been reduced, while U.S. and Allied communication requirements had consistently increased. In December 1968, Lt. Gen. Richard P. Klocko, DCA director, proposed three ways for meeting the Allies' communication needs: (1) lease satellite communications channels through U.S.-operated terminals; (2) lease channels with terminals operated by the Ally; and (3) establish Allied systems procured from American industry. The Joint Chiefs of Staff (JCS) endorsed the DCA recommendations because they would provide flexibility in dealing with particular Allied nations.* Also, in view of the limited DSCS-II capacity, the JCS proposed expanding the system to meet Allied needs.[9]

[redacted] In June 1969 Secretary Packard suggested a fourth option for Allied participation whereby NATO would procure and operate its own communication satellite system as an adjunct to the DSCS-II. The JCS and the military departments opposed this proposal. Secretary Seamans detailed for Secretary Packard the Air Force's objections. First, he noted, it would be unwise to allow NATO control over the DSCS. Thus, if a member nation disapproved a particular U.S. policy--for example, with respect to Vietnam--it could interfere with use of the system. Additionally, the export of DSCS technology violated the national policy "to encourage selected allied nations to use the United States national defense communications satellite system, rather than to develop independent system(s)." Further, foreign industrial participation in the DSCS required different contractual procedures. The latter, Dr. Seamans claimed, would complicate program management and delay implementation.[10]

[redacted] In view of these objections, Mr. Packard did not pursue the matter further and no decision was reached on

*Canada, Australia, and New Zealand had expressed interest in using the DSCS.

the NATO approach. However, in March 1970, the British secured approval for a follow-on to their Skynet satellite program. Provisions were made for the UK system to be interoperable with the DSCS-II. Earlier, Secretary Laird had turned down a similar request by the Federal Republic of Germany.[11]

TacSatCom

[redacted] LES-5 was the first in a series of experimental satellites developed by MIT's Lincoln Laboratory under Air Force Program 591. Launched on 1 July 1967, LES-5 initiated the space segment of the joint-service Tactical Satellite Communications R&D program. During fiscal year 1968, the satellite was tested in conjunction with a variety of earth terminals. The tests demonstrated the feasibility of air-to-ground, ground-to-air, and air-to-air ultra high frequency (UHF) communications via satellite relay.[12]

[redacted] The R&D program continued with the launch of LES-6, the second Lincoln Laboratory satellite, on 26 September 1968. TACSAT I, developed by the Hughes Aircraft Co. and the largest communication satellite built to date, was launched on 9 February 1969. As indicated below, both satellites represented significant advancement over LES-5:

	LES-5	LES-6	TACSAT I
Weight (pounds)	225	370	1,580
Dimensions (feet)			
Length	5½	5½	25
Diameter	4	4	9½
Output Power (watts)			
ultra-high frequency (UHF)	50	800	8,000
super-high frequency (SHF)			1,000
Orbit	near-synchronous	synchronous	synchronous

The ground equipment included 65 UHF and SHF terminals and 76 modulation-demodulation (modem) devices. Like the DSCS-II, the TacSatCom ground system experienced considerable technical difficulties. After some delay, installation was accomplished in the interval between January and September 1969 and the terminals performed satisfactorily in subsequent tests. LES-6 and TACSAT I were first stationed at 87° and 108° west longitude (wl), respectively. Following preliminary tests, LES-6 was repositioned over the Atlantic Ocean (38°wl). The move, completed in December 1969, was to permit cooperative testing by select NATO countries. TACSAT I remained at its original station through the end of fiscal year 1970 and was used to support the Apollo 10 and 11 lunar missions. The Air Force then undertook to reposition it to a point over the Pacific Ocean (180° wl).* This move was expected to be completed by February 1971.[13]

[redacted] Meanwhile, the Tactical Satellite Executive Steering Group (TSEG)+ had been greatly impressed with the LES-5 performance. In March 1968, the Group drafted a 3-phased plan to speed TacSatCom system acquisition. In the first phase, R&D assets including LES-6, TACSAT I, and the ground terminals would be converted to operational use. Next, between 1969 and 1972, the system would be expanded to include another satellite (the TACSAT IA backup) and additional terminals. The third phase, beginning in 1972, called for deployment of a fully operational system--TacSatCom II.[14]

[redacted] On 6 September 1968, Secretary Nitze approved converting the TacSatCom to operational status upon completion of the R&D tests (i.e., at the end of fiscal year 1970). However, he rejected the proposal to expand the system because of the $200 million funding required for the effort. He also asked the service secretaries to formulate a Technical Development Plan (TDP) for the TacSatCom II.[15]

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*Operational considerations required it be stationed at 171°. [Intv (S), author with Lt. Col. John Mayers, Dir/Space, 4 Jan 72]

+Formed in fiscal year 1966 as the Tri-Service Tactical Satellite Executive Steering Group. It was redesignated in June 1967 after admittance of Marine Corps representation. The TSEG coordinated the various service efforts during the TacSatCom R&D phase.

[redacted] Mr. Nitze's decision was discussed at a meeting of the RDA Council* held in October 1968. The Air Force conferees noted that the TSEG merely served as program coordinator with each service responsible for development of a particular system component. They concluded that a single executive authority was needed to perform system engineering and acquisition management for the TacSatCom II. Moreover, they believed that the Air Force was uniquely qualified for the task. The conferees recommended that the Air Force actively solicit the executive management role. The TSEG arrangement continued through the end of the TacSatCom R&D phase. In June 1970, however, the JCS named the Air Force executive manager for the interim operational system.[16]

[redacted] The TacSatCom II plan envisioned deployment of a limited operational system beginning in 1972. TACSAT II satellites, improved versions of TACSAT I, would serve aircraft and ships. Ground communications would be provided through the DSCS II until a more advanced tactical system could be deployed in 1975. Military communications requirements under TacSatCom II totaled more than 11,500 terminals; the Air Force alone needed about 3,300 terminals. Other operational specifications, including nuclear hardening, raised the proposed system's cost considerably. The Air Force, in view of higher priorities assigned to such projects as the B-1 and F-15, was reluctant to commit funds for TacSatCom. The other services were in similar positions. In October 1969 the TSEG submitted the TacSatCom TDP to the Secretary of Defense. They considered system acquisition highly desirable and technically feasible. Nevertheless, its cost--estimated at $2.4 billion over a 3- to 5-year period--was prohibitive. Recognizing this, the TSEG did not recommend TacSatCom II implementation but urged its approval in principle and continued development.[17]

[redacted] In March 1970 the Air Force Systems Command proposed to Headquarters USAF a Military Satellite Communications (MilSatCom) program as an alternative to TacSatCom II. Based on TacSatCom technology, this program was designed primarily to meet critical command and control needs. Its five satellites--

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*The Research, Development & Acquisition Council--established in September 1965--was comprised of Air Staff and Air Force System Command members.

[redacted]

three in synchronous equatorial orbit and two in elliptical orbit around the poles--would resemble the LES-6 spacecraft. Initial operational capability could be achieved in 24 to 30 months at a cost of $300 million, with the entire 650-terminal system available by early 1974. The Air Staff undertook to prepare a Development Concept Paper (DCP) for submission to OSD. This work was not completed before 30 June 1970. In addition, an OSD decision had to await results of an indepth study* on communication satellites due later in the year.[18]

*See p 18.

[redacted]

[redacted]

III. MISSILE AND SPACE DEFENSE

[redacted] During fiscal years 1969 and 1970 the Air Force investigated several missile and space defense concepts to ensure the survival of its strategic forces. Both "active" and "passive" defenses were considered to counter a compound threat from intercontinental ballistic missiles (ICBM's), submarine-launched ballistic missiles (SLBM's), the fractional orbit bombardment system (FOBS), and hostile satellites. Among the passive concepts was satellite basing, the permanent dispersal of Strategic Air Command (SAC) bomber and tanker cells to widely separated airfields. To protect the Minuteman ICBM fleet, the Air Force advocated their relocation into superhard rock silos. For active defense, the Air Force proposed converting Minuteman to a dual purpose offensive-defensive system. Also considered was a hardened terminal interceptor dedicated to defend particular missile silos. In addition, there were schemes to redeploy the Minuteman atop mobile missile launchers and to develop an airborne ballistic missile intercept system (ABMIS) to be carried aboard C-5A transports. Finally, advanced technology programs were under way to provide future capabilities, including terminal homing interception, midcourse flight surveillance, and nonnuclear kill.

ABM Options

[redacted] The above programs and proposals to insure the survival of USAF strategic forces also involved an important roles and missions issue. This issue became acute in September 1967 when Secretary McNamara approved the Army's deployment of the Sentinel anti-ballistic missile (ABM) system. According to Mr. McNamara, Sentinel would help shield the United States in the 1970's from attacks by nuclear-tipped ICBM's being developed by the Chinese People's Republic (CPR).* The Air Force believed the Army ABM infringed upon its traditional role for area defense. Moreover, Sentinel had substantial resources for expansion, including

*The Chinese tested a prototype midrange ballistic missile with a 20-kiloton nuclear warhead on 27 October 1966. They exploded their first atomic bomb on 16 October 1964, their first thermonuclear bomb on 17 June 1967.

[redacted]

a broad technical base, a multibillion dollar funding commitment, and strong political backing. USAF officials felt that Sentinel, if left unchallenged, might ultimately take over the Air Force's critical strategic command and control mission.

[redacted] These considerations led to a searching re-evaluation of Air Force objectives in missile and space defense. In December 1967, General McConnell approved formation of an ad hoc Air Staff group. It was to consolidate past and current Air Force efforts into a coordinated action plan (CAP).* The CAP would define the Air Force position and recommend steps leading to its adoption. Concurrently, a missile and space defense "white paper," documenting the Air Force case for specific systems, was prepared through normal Air Staff channels. Both efforts recognized the futility of advocating a wholesale replacement of Sentinel. They concentrated instead on ways to complement the Sentinel system and thereby regain an Air Force role in missile and space defense.[1]

[redacted] Most Air Force studies proposed an active defense in which a part of the Minuteman ICBM force would be converted into a dual purpose system for offense and defense. Called MODS,+ the concept promised several advantages which could complement Sentinel. Foremost was the fact that Minuteman was already an operational system. Its missiles, launchers, and control facilities were hardened against nuclear effects. The longer range Minuteman could provide area defense in depth and thereby reduce the number of Sentinel sites needed. The MODS could achieve initial operational capability as early as fiscal year 1973 and at consistently less cost than Sentinel. Finally, the MODS could later incorporate a nonnuclear warhead‡ being developed by the Air Force.[2]

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*It was hoped the CAP would reconcile conflicting positions within the Air Force. In December 1968 the Chief of Staff approved extending the CAP concept to other Air Force projects. He established a separate CAP division under the Deputate of Plans and Operations for a year's trial. [Ltr(S/AFEO), CSAF to DCS/Plan and Ops, subj: Coordinated Action Plan (CAP) Application, 18 Dec 68.]

+Minuteman Offensive-Defensive System (MODS).

‡See "DSDD Program" later in this chapter.

[redacted] During August and September 1968, as the MODS proposal underwent scrutiny within the Air Staff board structure, a number of problems surfaced. Thus, there was the question as to which command--SAC or ADC--should exercise command and control. SAC also was concerned [illegible]sion of Minuteman ICBM's to a defensive mode might be interpreted as an indication it could afford to reduce its missile force. SAC officials, therefore, insisted that any MODS proposal be accompanied by a request to raise the 1,000 Minuteman ceiling proportionately. Dr. Alexander Flax, the Assistant Secretary of the Air Force for R&D, believed more study was needed to confirm MODS technical feasibility. Despite these problems, Secretary of the Air Force Harold Brown‡ decided it was time to act. On 6 December 1968 he recommended MODS development to OSD. Deputy Secretary of Defense Nitze encouraged continued study of the concept, but thought it "unwise" to rush into system engineering. He further advised the Air Force to coordinate its efforts with the Advanced Research Projects Agency (ARPA).[3]

[redacted] Sentinel deployment was temporarily suspended in early 1969 to allow the newly inaugurated Nixon administration an opportunity to review it. Secretary Brown could not wait. On his last day in office, 14 February, Dr. Brown directed AFSC to prepare development plans for MODS. He also asked OSD to approve $63 million* for MODS, optical sensors, and nonnuclear kill technology programs. Deputy Secretary Packard in response labeled the proposals "premature" and "high risk." He reminded the Air Force that the Army had primary responsibility for ballistic missile defense. Nevertheless, Mr. Packard stated he was receptive to new initiatives and authorized the Air Force to transfer $2 million from its Advanced ICBM Technology program+ for missile and space defense studies.[4]

*The proposed distribution of these fiscal year 1970 funds was: $16 million for MODS, $10 million for optical sensors, and $37 million for reinstatement of two demonstration flights of terminal homing and nonnuclear kill technology (discussed later in this chapter). At the end of February the Air Force Comptroller, Lt. Gen. J. F. Crow, adjusted the request downward by $10 million.

+See Jacob Neufeld, USAF Ballistic Missile Programs 1969-1970 [redacted] (Off/AF Hist, Jun 71), p 41.

‡Dr. Brown served as SAF from 1 October 1965 to 14 February 1969.

[redacted] Meanwhile, the ABM issue had captured public attention and launched a Congressional inquiry. Appearing at one "closed door" session, Air Force officials supported Sentinel deployment, but took the opportunity to disclose their work in nonnuclear kill technology. The concept elicited Congressional interest as well as annoyance that the subject had not been revealed previously. One Congres[redacted] "If this gets out it will be a first class national scandal." OSD, however, downgraded these projects as technologically premature and Dr. Foster, DDR&E, urged the Air Force to restrain Ling-Temco-Vought--the prime contractor for the Defense Subsystem Development and Demonstration (DSDD)* program--from "overselling" the concept in testimony before Congress.[5]

[redacted] On 14 March 1969 President Nixon announced his decision to reorient Sentinel. He noted Sentinel's objective of defending cities might be considered provocative since it implied the capability to launch a premptive "first strike." Renamed Safeguard, the new ABM system's major goal was to defend the "land-based retaliatory forces." Thus, by enhancing the latter's survival, Safeguard would tend to stabilize the world's delicate deterrence equation. Moreover, the Chinese Communist threat had not materialized as rapidly as expected, while Soviet capabilities--notably in the development of larger and more accurate ICBM's--were greater than had been predicted.[6]

[redacted] The Air Force had anticipated this reorientation several months earlier. In August 1968, the CAP group noted a memorandum from Dr. Foster which instructed the Army to expand their ballistic missile defense R&D and improve their surveillance capabilities. Since the measures were designed to provide ABM coverage against a broad range of threats, the action encroached on Air Force roles and missions. Air Force officials were also disturbed by the "obvious rapport" which had developed between "OSD, Army and the Advanced Research Projects Agency [ARPA]." For example, in March 1968 the Army created the Advanced Ballistic Missile Defense Agency (ABMDA) which was manned in part by an impressive cadre of key scientists+

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*See pp 30-32.

+Dr. Patrick J. Friel and 10 members of the ARPA Project Defender staff were transferred to ABMDA. The project contained the greatest accumulation of funds and expertise in ballistic missile defense R&D.

transferred from ARPA. The CAP group concluded that these and related actions tended "to erase any opportunity to match competitive capabilities [with the Army]" and "foreclose the Air Force from a future role in aerospace defense."[7]

[redacted] In the summer of 1969 the ABM controversy reemerged as the Congress prepared to hold "a great debate" on the issue. Secretary Seamans took this opportunity to promote Air Force alternatives to Safeguard. In a memorandum to OSD, Dr. Seamans argued that the 10-year costs to relocate Minuteman into superhard rock silos were less than half the cost of Safeguard deployment. Moreover, the hard rock silo (HRS) program offered the same degree of Minuteman survival as Safeguard had promised. Secretary Packard and Dr. Foster did not share the Air Force's enthusiasm over HRS, but suggested the Air Force continue to study its hardened terminal defense system. Meanwhile, on 6 August, the President's Safeguard plan passed by one vote in the Senate. By year's end HRS funds for fiscal 1969 and 1970 were sharply trimmed.* The effect of the reductions was to stretch out the program's initial operational capability, making it a less attractive option. On 11 December OSD cancelled HRS and replaced it with the Minuteman Rebasing Program.[8]

[redacted] Despite the passage of Safeguard Phase 1† deployment and the setbacks to the HRS program, Secretary Seamans remained unconvinced that an active defense was superior to a passive one. In November 1969, commenting on plans to expand the Safeguard system, he questioned certain basic assumptions which had been made. For example, the Army's intelligence figures conflicted with NIPP-69‡ threat projections. The latter credited Soviet ICBM's with possessing greater accuracy than did the Army estimates. Thus, Safeguard planning had been shortsighted. It did not provide for obvious Soviet tactical improvements, including penetration aids, pre-cursor (radar blackout) attacks, or a direct attack on Safeguard radars. In addition, to these vulnerabilities, Secretary Seamans discerned another limitation--the lack of command and control integration between U.S. offensive and

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*For a fuller account of the HRS demise see Neufeld, USAF Ballistic Missile Programs, 1969-1970, pp 24-32.

†Phase 1 provided ABM sites at Grand Forks AFB, N. Dak., and Malmstrom AFB, Mont.

‡National Intelligence Protection for Planning-1969.

defensive forces. Despite this and other opposition, the President in late January 1970 decided to go forward with both the first phase and second phase* of the Safeguard.[9]

[redacted] While Air Force officials publicly supported the President, within the Department of Defense they continued to advocate alternatives to Safeguard. In April 1970, Secretary Seamans wrote to DDR&E to again emphasize the importance of capitalizing on the huge Minuteman investment. Although HRS had been disapproved, the Air Force sought approval to harden existing silos and to develop the hard point defense (HPD) system. Dr. Foster was receptive to the HPD concept proposal, but appeared to favor another scheme called shelter basing. The latter involved construction of moderately hardened and widely dispersed missile shelters. Upon warning of attack, Minuteman ICBM's--deployed atop mobile missile launchers--would assemble at one or more of these shelters. Since the enemy could not know which shelters were occupied, his targeting problem would be compounded. The Air Force, however, discovered serious operational and technical problems with shelter basing and opposed it.[10]

[redacted] Meanwhile, the MODS proposal lay dormant. Besides the internal dispute regarding command and control by particular Air Force commands, there was a general lack of enthusiasm for MODS in the Air Staff. Here, the "older heads" viewed the MODS as an expensive project which would divert precious funds from sorely needed aircraft programs. At any rate, no agreement could be reached on the Air Staff towards establishing a firm position on missile and space defense. The MODS technical development plan, which had been completed in March 1970, was temporarily shelved. At the end of fiscal year 1970 it had still not been forwarded officially to OSD and there was considerable doubt as to its future utility in light of the strong political support that Safeguard enjoyed.[11]

*Under Phase 2 Safeguard sites would be installed at Whiteman AFB, Mo., and at either Warren AFB, Wyo., or Washington, D.C.

DSDD* Program

[redacted] In May 1964 the Air Force declared Program 437 operational. Based on Johnston Island in the Pacific, Program 437 employed Thor missiles to give the nation a modest antisatellite capability. However, the system was only effective against satellites operating in certain orbits and its created uncertainty as to when, if indeed ever, it might be used. To add flexibility, the Air Force explored development of a nonnuclear antisatellite system called OSD did not regard the follow-on system urgent. At the end of 1966, it approved but stretched out the program's schedule by sharply curtailing fiscal year 1968 and 1969 funds.[12]

[redacted] Meanwhile, as discussed earlier, the Air Force had searched for concepts to help substantiate its case for a missile and space defense role. terminal homing interception and nonnuclear kill technology filled this need perfectly. During fiscal year 1966 the Air Force requested permission to demonstrate ballistic missile interception by firing systems against reentry vehicles launched from Vandenberg AFB. In June 1967 OSD tentatively approved the 8-launch demonstration but directed the Air Force to coordinate the effort with an ARPA program in mid-course flight interception. However, in February 1968, following repeated delays and the Sentinel system deployment decision, ODDR&E cancelled It cited budgetary pressures as the reason for the action.[13]

[redacted] In response, Secretary Flax called attention to long-wave infrared (LWIR) technology. Noting LWIR application to ballistic missile defense, he persuaded DDR&E to reinstate as a technology effort. Renamed the Defense Subsystem Development and Demonstration program,+ its fiscal year 1969 budget was $1 million plus $9 million transferred from Army funds. On 3 September 1968, Dr. Foster approved a 4-flight DSDD test series. To minimize costs, two "early" demonstration flights would be conducted beginning in

*Defense Subsystem Development and Demonstration.

+Also called the Special Defense Program (SDP).

July 1969. The LWIR guidance sensor, carried aboard a stripped-down payload vehicle--i.e., with maneuvering engine, removed--would verify DSDD's search and tracking capabilities. Complete system tests--to demonstrate terminal homing interception --would be launched about a year later. ODDR&E indicated that $20 million would be budgeted for the DSDD program in fiscal year 1970.[14]

[redacted] By year's end, however, DSDD funding had been cut to only $5 million. The Air Force protested it could not conduct a meaningful program at this level. During February and March 1969, the Air Force and ODDR&E agreed to restore $7.9 million to permit launching only the two early demonstration flights. Subsequently, the DSDD program experienced repeated delays due to late delivery of the test payloads by the contractor. The first launch slipped to December 1969, then to March, and finally to April 1970. This slippage also produced a $2.6 million fiscal year 1970 funding deficit. In December 1969 the Air Force appealed to ABMDA for funding support. The latter, however, advised that a single test flight would satisfy Army requirements, with a second flight being contingent upon the results of the first. When the first DSDD demonstration, launched 25 April, ended in failure,* it doomed the program. A month later DSDD was officially cancelled on the basis of unacceptable costs.[15]

[redacted] Although "missile and space defense" had increasingly come to mean missile defense, the Air Force did not abandon interest in developing a nonnuclear antisatellite system+. In February 1970 Under Secretary of the Air Force John McLucas asked for the earliest and cheapest means of demonstrating such a capability. SAMSO‡ presented several options ranging in cost from $20 million to $80 million, depending upon

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*Later investigation determined the failure of the sensor was due to air leakage into the vacuum chamber.

+Interest had been rekindled in late October and early November 1968 when the Soviets launched Cosmos 248, 249, and 252 spacecraft. When it appeared that the first satellite had destroyed the latter two, the Soviets were credited with having acquired a nonnuclear, space-based antisatellite system.

‡Space and Missile Systems Organization, an element of AFSC.

the number of launches and degree of standby capability desired. On 1 April, Gen. John D. Ryan, the Air Force Chief of Staff, concurred with the $36 million "simple reaction capability" option. Also designated Defense III, this option proposed using existing resources from Program 437, the DSDD project, and the Apollo program's LEM descent engine, among others. These assorted components would be used in conjunction with three Thor boosters. One of the boosters would launch a demonstration flight, while the remaining two sorties could either be converted to operational use, or reserved for additional demonstrations. If approved, Defense III could make its first test flight 15 months later. However, in view of the tight budgetary situation, General Ryan suggested the Air Force solicit funding support from OSD. Meanwhile, he directed AFSC to prepare a comprehensive technical development plan for the system by August 1970.[16]

[redacted] Before Defense III could proceed further, Mr. Packard issued a momentous decision. On 4 May 1970 he directed the Air Force to phase down Program 437 by the end of the fiscal year. His rationale was "the unlikelyhood [sic] that the United States would ever use the 437 system." As a substitute, Secretary Packard asked the Army and the Air Force to conduct low-cost technology programs to develop a nonnuclear antisatellite capability. Further, since there appeared to be no urgency for system acquisition, he specified the system would not be required for continuous alert and its satellite acquisition and identification functions could be performed by other means. Subsequently, Secretary McLucas described the Air Force Defense III concept to OSD and offered it as a candidate for the nonnuclear antisatellite mission.[17]

IV. SURVEILLANCE AND WARNING

A Master Plan

[redacted] In December 1967, the Directorate of Doctrine, Concepts, and Objectives--supported by SAC, ADC, AFSC and the RAND Corporation--initiated a mission analysis to predict the scenario of strategic operations in the 1970's. Called STRAT-70,* the study focused on the growing interaction between offensive and defensive forces, and command and control systems. Space technology emerged as the key to effective coordination of sensors, forces, and commands during the coming decade. By June 1968, the study group had drawn a rough outline and begun to draft a battle management plan. STRAT-70 incorporated the products of another mission analysis completed at about this time--Surveillance of Objects in Space in the 1970's (SOS-70).[1]

[redacted] The SOS-70 study,+ described as "the most comprehensive appraisal of space surveillance . . . to date,"[2] buttressed the STRAT-70 analysis. The former advocated a complete reorientation of the Air Force's surveillance and warning posture from ground-based systems to spaceborne ones. Briefly, SOS-70 advocated developing four major systems.

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*Strategic operations in the 1970's was considered in the preparation of the Space Task Group's report to the President (see Chapter I). It stressed the danger of overreliance on the doctrine of assured destruction, offering instead to enhance national strategy with greater flexibility. [See Hist [redacted] Dir/Doctrine, Concepts and Objectives, 1 Jul-31 Dec 68, p 38, 1 Jan-30 Jun 69, p 39, 1 Jul-31 Dec 69, pp 31-34, and 1 Jan-30 Jun 70, pp 35-40.]

+A joint ADC and AFSC effort.

‡See discussion below of Program 949.

[redacted] Initial operation of the SOS-70 systems was projected for the 1972-1974 time frame. Estimated 10-year costs were $3.4 billion, with $300 million already approved. Once the system attained full capability, existing ground-based sensors could be phased out, yielding a $600 million saving. Hence, the net 10-year cost would be reduced to $2.5 billion. The SOS-70 proposal won strong Air Force endorsement* and in J[redacted]the Air Force Council submitted a "white paper" to the Chief of Staff urging his support. General McConnell agreed with SOS-70 objectives, but asked for additional study of LWIR technology, system hardness, and communications survivability.[4]

[redacted] After completing their work, the SOS-70 group joined an on-going ADC effort dealing with the future design of the Spacetrack+ system. Completed in September 1968 the Spacetrack study had outgrown its limited bounds, emerging as the Air Force Master Plan for Space Surveillance. The plan's aim--to develop a "worldwide, credible, and integrated surveillance" system--bore the unmistakable stamp of SOS-70 members. Generally, the master plan called for an incremental transition to space surveillance systems in three stages. During the first stage, existing

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*One notable dissent was registered by SAC. The latter feared that SOS-70 would dilute (the HASP system) justification and that SAC's battle management capability would hinge on the survival of the SCC. [Msg [redacted] SAC to Hq USAF, no subj, DPL 04/2110Z Jun 68.]

+See pp 36-38.

ground-based sensors would receive only minimum essential modifications to permit continued operation. Stage II would be a period of study and analysis to allow definition and deployment of new systems* needed in the mid-1970's. Finally, the third stage would see an orderly replacement of the old systems by the new.[5]

[redacted] Submitted to General McConnell on 12 September 1968, the plan was scrutinized by the Air Staff during the next three months. On 20 December General McConnell forwarded it to Secretary of the Air Force [redacted] recommended approval. However, due to the change in the administration, the plan lay dormant in the Office of the Secretary of the Air Force (OSAF) until May 1969. At that time, Secretary Seamans approved the plan and submitted it to OSD as a planning guide. He cautioned that the plan was subject to changes in technology, requirements, and budgets. Therefore, it would require annual updating.[6]

[redacted] Meanwhile, some exploratory work on SOS-70 systems got under way. The LASP (or midcourse surveillance) system studies were budgeted at $300,000 during both fiscal years 1969 and 1970. Advanced development of a midcourse surveillance system was approved at a $2 million level for fiscal 1971. Investigation of LWIR sensors and other electro-optical instrumentation began in fiscal 1970. Designated the Advanced Sensor Technology program, it was funded at $3.2 million. However, the effort suffered from fragmentation† and some doubt existed as to whether the ultimate decision would be for a gound or space-based system.[7]

[redacted] The fiscal year 1970 budget also contained $2.4 million for development of extra high frequency communications technology applicable to the space data relay satellite system.

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*Essentially, the systems advocated by SOS-70 [Hist ([redacted], 14 AF, 1 Jul 68-30 Jun 69, Annex, pp 1-9.]

†Related technology efforts were conducted under the DSDD program (see preceding chapter) and the Sentinel Assist studies (see "The Defense Support Program.") Moreover, the Advanced Sensor Technology program contained several tasks which were managed by different elements on the Air Staff. [Memo ([redacted], Col. Paul Baker, Jr., Dir/Space (Tech/Div), to Gen. Hedrick, subj: Program Management for Advanced Sensor Technology and Related Efforts, 12 Sep 69.]

Engineering development of the relay satellite system also began in fiscal year 1970 at a modest $600,000 level. Emphasis was placed on first providing communications linkage between the HASP* system and CONUS by 1973, while deferring developments for multiple users to the post-1975 period.[8]

[redacted]

Spacetrack

[redacted] USAF's Spacetrack System+ employed radar and optical sensors to detect, identify and track orbiting man-made objects and report them to the North American Air Defense Command (NORAD). The primary network included surveillance and tracking radars at Diyarbakir, Turkey; Shemya, Alaska; and Moorestown, N.J.; and Baker-Nunn cameras at Edwards AFB, Calif; Sand Island (near Johnston) in the Pacific; and Jupiter, Fla. Additionally, Spacetrack received cooperative data from the Ballistic Missile Early Warning System (BMEWS); an AFETR tracker at Trinidad in the West Indies; the Smithsonian Astrophysical Observatory's 11-station network; and from various intelligence sensors. Transferred to the Air Force from ARPA in October 1960, Spacetrack evolved by expediency rather than design using old equipment inherited from the USAF Security Service. Spacetrack had proven adequate during the early 1960's, but the ever-growing space object population‡ saturated and taxed the system's capabilities. In 1966 ADC, operator of the Spacetrack, had called for extensive modernization. The Air Force, however, rejected making heavy investments in a program with so obviously a limited future. The alternative chosen was to apply the minimum modifications needed to sustain Spacetrack until newer ground sensors could be incorporated and the transition made to satellite systems.[9]

[redacted] In February 1969, the Computer Sciences Corp. was awarded a $4.3 million contract to provide Diyarbakir and Shemya

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*See p 41.

+Spacetrack and the Navy's Space and Surveillance network (SPASUR) formed the DOD Space Detection and Tracking System (SPADATS).

‡For example, on 30 June 1968 1,329 space objects were identified, a year later the number rose to 1,731, and by the end of fiscal year 1970, the population reached 1,858. [History ([redacted]), ADC, FY 1969, p 427; FY 1970, p 335]

new computers and automated subsystems for rapid and accurate data handling. Subsequently, problems involving radar-computer integration and contractual disagreements slipped the expected completions of Diyarbakir to October 1970 and Shemya to March 1971. Another change, called the "Anders interface," was completed in October 1969.

This significantly improved acquisition and tracking of Sovi[redacted] and space launches. Also, direct communications were established between Shemya and the Clear, Alaska, BMEWS site and between Shemya and Advanced Research Instrumentation Ships

A modification program, begun in 1966, to improve the resolution capability* of the Moorestown radar, was completed in February 1969. A prototype tracking radar for BMEWS, the Moorestown FPS-49A radar was earmarked for service in Thailand beginning in fiscal year 1971. Its primary Spacetrack functions would be assumed by a new radar+ operating at Eglin AFB, Fla. In June 1970 ADC and AFETR negotiated a functional transfer from the Trinidad radar to a TPQ-18 sensor at Ascension Island in the Atlantic. The latter was better situated and would be less expensive to maintain than the Trinidad station.[10]

[redacted] The Air Force also acted to relocate Spacetrack's Baker-Nunn cameras to the Southern Hemisphere where they would enjoy better weather conditions and improved strategic siting. In July 1968 agreement was reached with New Zealand to install an unused camera at Mount John; this project was completed in October 1969. In November arrangements were made to move the Jupiter camera to San Vito dei Normanni Air Station, Italy, where it would be placed into operation in late 1970. A third action, scheduled for the end of 1972, would relocate the

*The Moorestown radar could not distinguish between two objects orbiting closer than 160 NM. A pulse compression modification promised to improve resolution to 2,500 ft and reduce accuracy measurement from 3 NM to 150 ft.

+The FPS-85 phased array radar is discussed below.

[redacted]

[redacted]

Sand Island camera to a site near Perth, Australia. Meanwhile, the Air Force had completed development of a prototype FSR-2 electro-optical sensor at the end of fiscal year 1969. The FSR-2 demonstrated it could detect non-transmitting satellites orbiting at synchronous altitudes (about 22,000 NM). The Air Force sought approval to deploy the device at Cloudcroft, N. Mex.[11]

[redacted] The first radar specifically developed for Spacetrack--the FPS-85 phased array--became operational on 20 December 1968. Located at Eglin AFB, Fla., this advanced system towered 13 stories and featured simultaneous tracking of multiple satellites at great distances,* with a high degree of discrimination. Moreover, the FPS-85 served as an adjunct to BMEWS and SLBM detection systems and supported NASA's Apollo missions. Originally destroyed by a fire in January 1965, the facility had been rebuilt by May 1967. Although scheduled to become operational in April 1968, the contractor (Bendix Corp.) had run into serious difficulties with the computer software and failed to deliver the necessary technical maintenance data on time. Still, the FPS-85 demonstrated its worth by identifying hundreds of space objects previously classified as "unknown." Subsequently, despite periodic outages (blamed on the "unusual bugs" affecting most new systems) the phased array radar achieved full operational capability on 25 May 1970. Its completion permitted phaseout of the Moore[redacted] radars and provided the first coverage of Soviet spacecraft passing over the CONUS from a southerly direction.[12]

Vela

[redacted] Vela was a joint DOD-Atomic Energy Commission (AEC) satellite program designed to detect violations of the Nuclear Test Ban Treaty within or outside the earth's atmosphere. First launched in October 1963, each Vela payload comprised a pair of diamond-shaped spacecraft which carried extremely sensitive electronic and optical sensors. Operating opposite one another in a 60,000 NM high circular orbit, the Vela satellites also furnished

*Specifications called for detection at 2,000 NM (slant range of 3,700 NM).

[redacted]

data. Through April 1967 four successful launches of two satellites each had been conducted. Vela V, the final launch in the series, was scheduled for a 1 December 1968 flight.[13]

[redacted] In July 1968 AEC ground testing of the Vela V payload revealed a high failure rate of the spacecraft's integrated circuitry. As a precaution, all of the nearly 10,000 circuits were replaced and the launch postponed. Vela V was successfully launched on 23 May 1969. However, its subsequent on-orbit performance proved erratic. The major problems involved temporary loss of earth orientation (downward looking capability) and spin rate variations. Although these anomalies were minimized through orbital control adjustments, it was feared that Vela V's effectiveness would be seriously degraded if either satellite permanently lost earth orientation.[14]

[redacted] Earlier, in March 1969, Dr. Foster entertained the idea of launching the Vela V backup satellites (hereafter VB). He asked the Air Force to prepare a Vela VB launch plan based on the assumption Vela V would be successful. Dr. Foster noted that since the spacecraft and Titan IIIC booster were on hand, this presented an opportunity to extend Vela capabilities and supplement Also, because the latter would not provide comparable nuclear explosion diagnostics initially, Vela VB could fill the gap during fiscal years 1972 and 1973. The Air Force developed and submitted the Vela VB plan a month later, but no action was forthcoming.[15]

[redacted] Meanwhile, Vela V's difficulties continued. Technical evaluation by SAMSO and TRW, Inc., personnel concluded the Vela V expected lifetime would likely be reduced from its designed 24 months mean-time-to-failure to about 11 months. If this prediction came true, Vela V would not survive long enough to cover a series of French nuclear tests anticipated for the summer of 1970. In August 1969, therefore, ARPA requested permission to launch Vela VB to meet the contingency. ODDR&E approved the request within two days.[16]

[redacted] The question of funding responsibility, however, raised some complications. ARPA had assumed that launch support costs would be borne by the Air Force, which was scheduled to take over Vela program management beginning in fiscal year 1971. Moreover, in October 1969, following Vela V's observation of a Chinese nuclear test, ARPA Director Eberhardt Rechtin declared his

agency's requirements had been satisfied. Thus, he reasoned, the Vela VB launch was based solely on Air Force needs. Faced with a funds scarcity, Air Force R&D Secretary Grant L. Hansen decided to reexamine Air Force requirements for a Vela VB launch. His review did not last long. ARPA -after further evaluating Vela V data on the CPR explosion--found the spacecraft had not achieved all its R&D objectives. Whereupon, Dr. Rechtin came out in support of the Vela VB launch.[17]

[redacted] With the Air Force case thus strengthened, Mr. Hansen approached ODDR&E. He proposed an April 1970 launch for Vela VB as most cost effective. However, fiscal year 1970 funding required an additional $9.3 million. Of the total, $1.8 million was needed to modify the spacecraft and $7.5 million* to support launch operations. Secretary Hansen claimed the costs were chargeable to ARPA, but suggested use of DOD emergency funds as an alternative. Dr. Foster resolved the issue by reprogramming the $1.8 million from ARPA accounts and "borrowing" $7.5 million from the Air Force's fiscal 1970 budget with compensation promised the next year.[18]

[redacted] In early 1970 Air Force, AEC, and contractor personnel isolated and corrected+ the Vela V anomalies. Subsequently, modifications were incorporated to the Vela VB spacecraft to eliminate the need for these procedures. Successfully launched on 8 April 1970, Vela VB represented the sixth and last launch of the series.

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*Actually, more than $6 million of the launch support costs were nonrecoverable funds. Also because the Titan III vehicle could not accommodate heavier payloads, cancellation of Vela VB would not have produced significant savings.

+The solution required placing part of the attitude control system (ACS) in an override mode. To prevent false ACS signals from interfering with the satellite's operation, additional radio frequency shielding was incorporated into Vela VB.

Vela Program Summary

Launch	Date	Spacecraft	Attitude Control	Status
I	Oct 1963	-	Spin stabilized	Retired
II	Jul 1964	-	" "	"
III	Jul 1965	6564 6577	" " " "	To be retired on 1 Jun 1970
IV	Apr 1967	6638 6679	" " " "	opnl for hi alt tests "
V	May 1969	6909 6911	Earth Oriented " "	Operational "
VB*	Apr 1970	7033 7044	" " " "	" "

Vela VB on-orbit performance proved excellent as only three of the 250 sensors aboard malfunctioned; these were considered negligible. Both Vela V and VB obtained valuable data on the French nuclear tests conducted between May and July 1970. At the close of fiscal 1970, the Vela program neared completion of its R&D objectives. The Vela Data Transmission System (VEDATS), designed to provide "real time" reporting, was in the last stage of becoming operational. Plans were also in progress to transfer Vela program management to the Air Force Technical Applications Center (AFTAC) during fiscal year 1971.[19]

[redacted]

Meanwhile, in August 1966, ODDR&E had approved the follow-on (formerly

*Launched aboard the first Titan III-C production model booster.

[redacted] . [redacted] At the time of approval, military leaders expressed concern over the Soviet test launchings of a fractional orbit bombardment system (FOBS). Such a nuclear-armed system could overfly the United States from the south, where the nation had no detection system deployed, or it might be launched on a low-northern trajectory to elude BMEWS radars. Believing that FOBS posed a first-strike threat, the Air Staff--supported by the JCS--sought to accelerate by one year. Civilian officials, on the other hand, had doubts about the FOBS; they saw it as a mainly psychological weapon. Moreover, Secretary of the Air Force Brown felt that the ground-based OTH† radar, then under development, was adequate for FOBS detection. On 6 November 1967, Secretary McNamara rejected the proposal to accelerate approving instead a speedup of the OTH effort. Nevertheless, Mr. McNamara directed the Air Force to maintain the existing If the satellite and its dedicated station could meet the

*Also called Block I, this phase of the R&D effort would provide an interim operational capability. The first truly operational phase was dubbed Block II and tentatively slated to begin in fiscal year 1972.

†The USAF 440L system, or forward scatter over-the-horizon (OTH) radar.

[redacted]

*

In early 1968, OSD requested the Air Force plan to incorporate

On 21 March 1968, Secretary of Defense Clark M. Clifford approved the development concept paper and asked the Air Force to submit implementation documents.[22]

[redacted] For the follow-on operational Program 949 (Block II)[+]

Envisioned to begin during the last half of fiscal year 1972, the operational phase was estimated to require $3 million and $12.5 million more in R&D monies for fiscal years 1969 and 1970, respectively. Beyond Block II, Air Force plans for remained indefinite. Secretary Brown acknowledged

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General Corp. was payload contractor and TRW, Inc. the spacecraft and integrating contractor.

[+] See asterisked note on preceding page.

[redacted]

While Dr. Brown noted that the alternative* was to extend to the R&D phase and postpone certain operational features, he endorsed making the necessary monetary investment and raising to full capability.[24]

[redacted] [redacted] On 6 December 1968, Secretary Clifford approved a modified version of the Air Force's R&D (Block I) deployment recommendation.

recognized the seriousness of the SLBM threat.

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*Dr. Flax believed ODDR&E was primarily interested in definition studies would take about two years to complete, ODDR&E would not likely permit early upgrading of Dr. Flax therefore proposed the Air Force continue "as a modification/product improvement program" following the R&D phase. In this way, the Air Force could make what modifications were necessary and buy the vehicles needed to maintain operation while awaiting approval for the upgraded system. [Memo ([redacted]), Flax to Brown, subj: Block II, 16 Nov 68.]

+In October 1968, Secretary Brown argued that the comparative effectiveness of the Sentinel system had not yet been sufficiently weighed against the effectiveness of B-52 bomber dispersal and [Memo ([redacted]), Brown to Foster, no subj, 12 Oct 68.]

survival, communications, and Finally, preliminary plans were laid to phase out several existing ground-based warning radars once . had demonstrated its capabilities. These included the BMEWS, System 474N (SLBM warning), and the Bomb Alarm System.*25

[redacted]

[redacted] By March 1969 mounting costs, low budgets,+ and demanding technical requirements‡ produced alterations in planning.

In June 1969, OSD approved December 1970 as the new initial operational capability date.

[redacted]

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*Although opposed by the JCS, the Bomb Alarm System was inactivated, for budgetary reasons, in February 1970. [JCSM ([redacted]), 42-70, to SECDEF, subj: Bomb Alarm System, 16 Jan 70; Memo ([redacted]), SECDEF to Chmn JCS, et al, subj: Bomb Alarm System, 1[redacted] Feb 70.]

+Fiscal year 1968 R&D funds had been cut from an initial request of $63 million to $39 million and then raised to $52.3 million in March 1968. The fiscal year 1969 budget was maintained by reprogramming and schedule stretchout. Thus, it appeared to have undergone significantly little change. Its June 1968 level stood at $94.3 million, while the next year it was only $1.3 million higher. [Hist([redacted]), Dir/Space, 1 Jan-30 Jun 68, p 18, 1 Jan-30 Jun 69, p 25.]

‡For example, in September 1968 the Air Force was obliged to reprogram funds to satisfy an OSD-imposed requirement that provided for

[redacted]

and "moderate hardening* within constraints of cost/schedule." The final phase--again put off to the post-1975 period--would not require procurement at this time, but was to be a study effort concentrating attention on defining future battle management aids.[26]

[redacted] Besides transferring funds to meet program deficits, the Air Force took more dramatic action. "A pri[redacted]as its contract with IT&T to develop the

Development costs had, by the summer of 1969, considerably exceeded the contractor's original estimate of March 1967. Consequently, the Air Force initiated talks with AEC officials. The result was a decision that the AEC could design a substitute device, an which would perform comparably or better than the IT&T sensor and at considerably less cost. In September 1969, the Air Force canceled its IT&T contract and signed an agreement with the AEC.[27]

[redacted] Perhaps the most significant problem involved rising costs for the program's data processing system. Secretary Flax had scught early approval for increased fiscal year 1970 funding.+

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*The JCS required all military satellite be hardened. [JCSM 431-6[redacted] to CSAF, et al, subj: Hardening Military Satellite Systems Against the effects of Nuclear Weapons, 27 Jun 68.]

+The fiscal year 1970 budget was raised from $62.7 million (December 1968) to $73.7 million (June 1969 to June 1970). [Hist[redacted] Dir/Space, 1 Jul-31 Dec 68, p 20, 1 Jan-30 Jun 69, p 25, 1 Jan-30 Jun 70, p 18.]

‡It subsequently appeared that resolution of this problem demanded immediate priority.

This figure compared with conservatively stated estimate of "within minutes." In June 1970 Headquarters USAF directed AFSC to act on SAC's request. [Ltr [redacted], Dir/Space to AFSC, subj: Warning Time of SLBM Launch, 10 Jun 70.]

[redacted]

[redacted]

OSD accepted the recommendation in December 1969, but only in part. The increased costs were recognized and procurement was approved for a data processing laboratory. However,

*OSD's hesitation to invest in ground-based systems may have been motivated by an interest in the Air Force's promising development of the satellite-to-satellite program. The latter was envisioned as a relay satellite with multiple purpose applications. [Memo ([redacted]), Hansen to ODDR&E, subj: Satellite Data Relay System, 5 Jun 69.]

[redacted]

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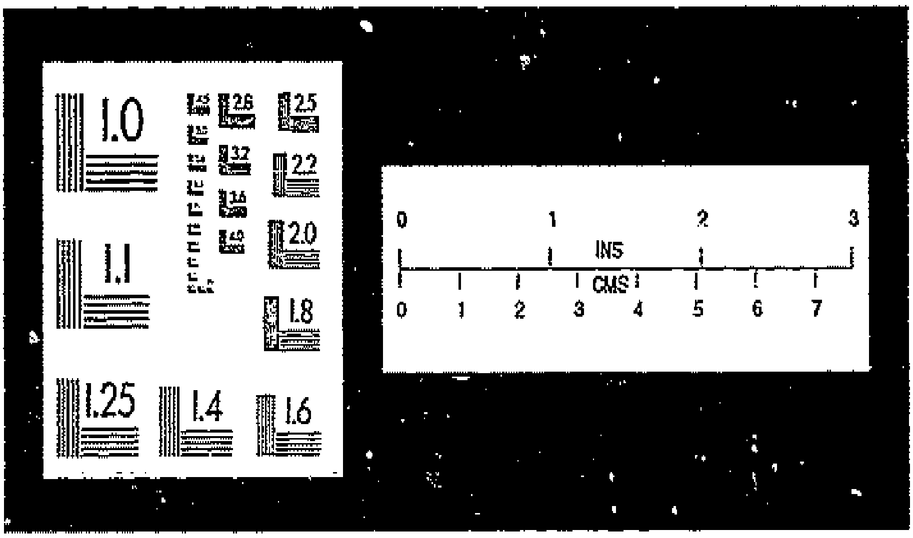

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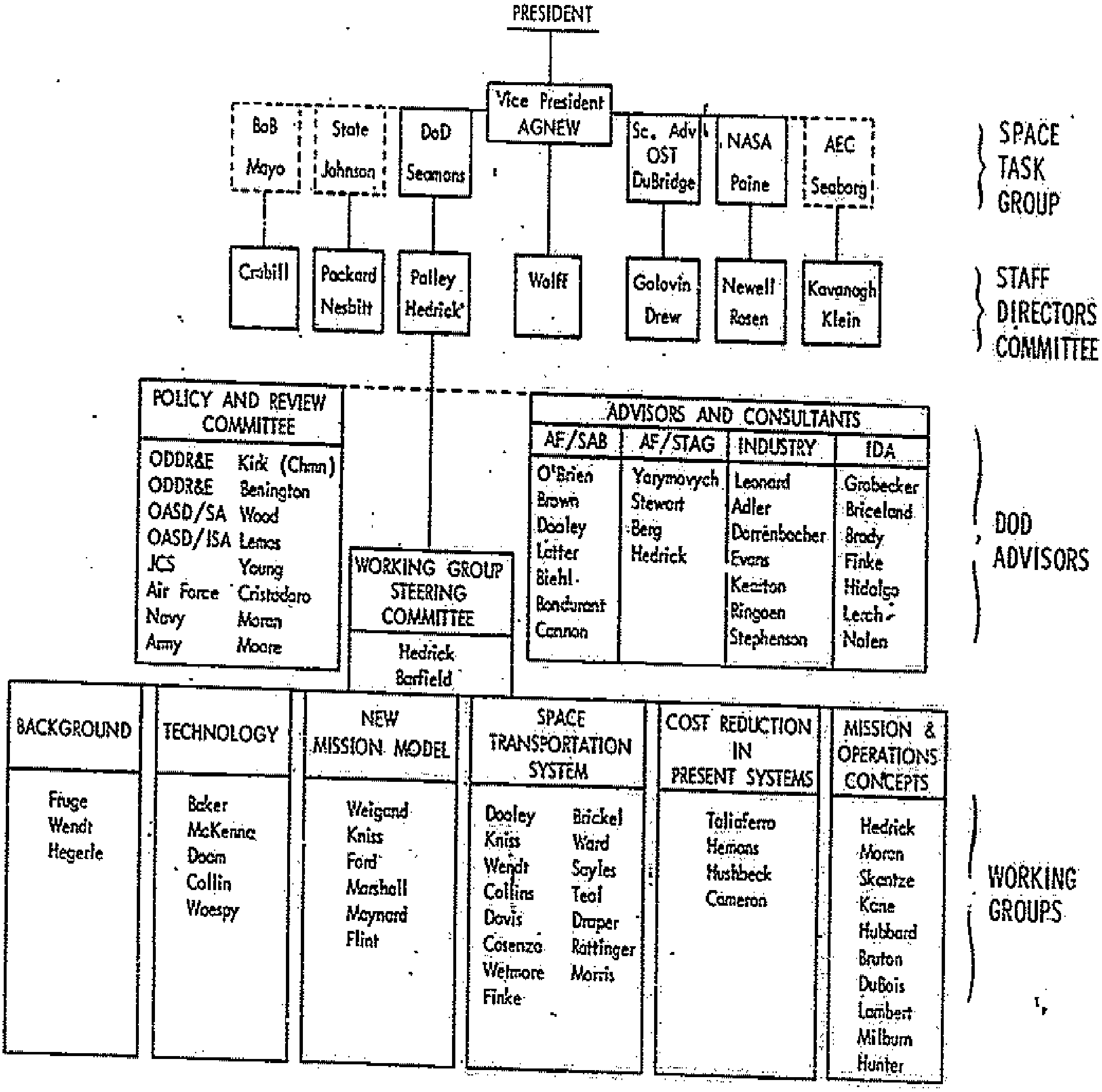
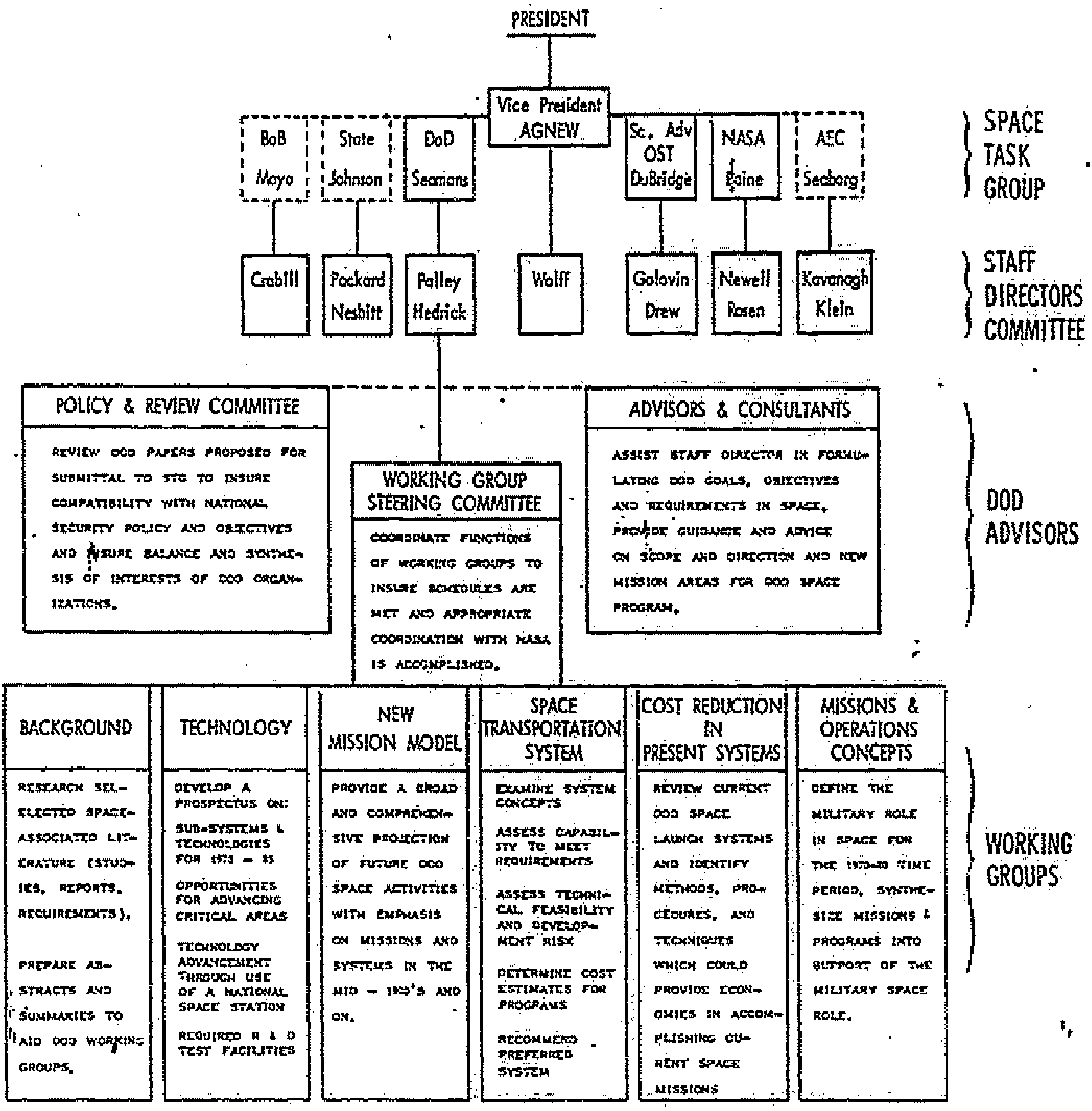
APPENDIX 1

COMPOSITION OF SPACE TASK GROUP



APPENDIX 2

FUNCTIONS OF SPACE TASK GROUP



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APPENDIX 3*

NASA-DOD Economy Studies

a. Manned Space Flight Programs

Purpose - To review each Agency's requirement for and utilization of manned space flight capabilities with the ultimate goal of bringing NASA and DOD into a position of greater commonality in manned space flight activities.

Result - More extensive joint use of major elements of the DOD-MOL and NASA-AAP programs than is now planned will not reduce costs, but savings may be achieved in the long run by planning joint approaches to future manned flight programs.

b. Manned Spacecraft Recovery

Purpose - To review requirements and resources and to effect economies in present and future operations.

Result - As additional space flight experience is obtained and additional confidence in flight systems is developed, savings will be achieved through phased reductions (to 1/2 to 1/3 of present levels) of recovery support. The use of heavy-lift helicopters may permit additional savings. The economic impact of a new generation spacecraft with land landing characteristics was not addressed.

c. Networks (Tracking and Data-Acquisition)

Purpose - To recommend near- and far-term steps that can be taken in order to achieve economy, while maintaining satisfactory support for NASA and DOD space missions.

*SOURCE: Minutes of AACB Meeting No. 49, 30 Jan 69.

Result - The study identified four areas of possible near-term cost reduction and at least one area wherein long-term savings could be achieved.

d. Space Environment Monitoring

Purpose - To determine whether, by consolidated management of probe and spacecraft hardware, facilities, and operations, a lower overall cost can be realized for space-environment monitoring activities.

Result - To date the study has identified possible areas of savings but immediate steps to achieve them could not be recommended pending further resolution of the mission-oriented implications of DOD programs. Additional coordination within DOD prior to further joint agency activity will be required.

e. Geodetic Satellite Programs

Purpose - To review jointly the NASA and DOD geodetic satellite programs in order to improve efficiency and reduce total cost.

Result - Program alterations with resulting near term savings have resulted from this study. Problem areas identified by the working group need resolution before the study can be completed and a final determination of possible long-term savings made.

f. Propulsion Technology

Purpose - To obtain more efficient utilization of the two Agencies' facilities and thereby make possible the closing of duplicate facilities.

Result - Program activities and use of facilities have been well coordinated for several years. The study teams found that unless total facilities are shut down, significant savings cannot be realized; and such steps could not be arrived at jointly.

g. Aeronautical Research and Development

Purpose - To examine the aeronautical activities of DOD and NASA in order to determine potential savings that might be achieved through joint action.

Result - This program has a long history of close coordination between DOD and NASA. Economies can be effected in aeronautics research and development only by eliminating programs whose output satisfies recognized needs. Eliminating programs was not recommended in view of the increasing importance of both military and civil aeronautics.

h. Standard Cost Format and Launch Vehicle Data Bank

Purpose - To develop a standard format for use by both Agencies in exchanging cost information for launch vehicles; and to establish and maintain a launch-vehicle-cost data bank.

Result - Agreement was reached on a standard cost format and on maintenance of a launch-vehicle bank of cost and performance data.

i. Launch Vehicles

Purpose - To identify a family of launch vehicles that can meet present and future needs of both Agencies more efficiently.

Result - The study confirmed NASA's choice of TITAN III-Centaur as a logical vehicle for future high velocity missions. The cost advantage of TITAN IIID/Agena in lieu of TITAN IIIC for future heavier DOD synchronous orbit missions identified in the study is being analyzed in detail by the Air Force.

j. University Programs

Purpose - To review jointly the major DOD and NASA university programs in order to identify unnecessary areas of overlap, and to provide a basis for closer coordination in the future.

Result - Because of prior close coördination, duplication of the university research grant programs of the two Agencies was negligible. Grant solicitations, reviews, and awards will continue to be coordinated.

k. Support Operations at Kennedy Space Center and the Eastern Test Range

Purpose - To identify major economies that may be achieved by "single contract or agency management" of common base support and technical services.

Result - Joint agreement was reached on 12 activities to be studied for near-term savings and 11 areas of possible long-term savings through consolidation of services. This study is to be completed in the latter part of 1969.

l. Agency Resource Application

Purpose - This study is concerned with effective utilization of specialists and project teams (government, industry or university) whose capability is considered to be a significant national resource.

Result - No specific problem areas were identified for study, hence no report was submitted.

GLOSSARY OF TERMS AND ABBREVIATIONS

AACB	Aeronautics and Astronautics Coordinating Board
ABM	anti ballistic missile
ABMDA	Advanced Ballistic Missile Defense Agency (Army)
ABMIS	Airborne Ballistic Missile Intercept System
Actg	acting
ADC	Aerospace Defense Command
ADF	Aerospace Data Facility
AEC	Atomic Energy Commission
AF	Air Force
AFB	Air Force Base
AFEO	Air Force Eyes Only
AFETR	Air Force Eastern Test Range
AFLC	Air Force Logistics Command
AFR	Air Force Regulation
AFS	Air Force Station
AFSC	Air Force Systems Command
AFTAC	Air Force Technical Applications Center
AMC	Army Materiel Command
ANG	Air National Guard
ARIS	Advanced Research Instrumentation Ship
ARPA	Advanced Research Projects Agency (DOD)
ASD	Assistant Secretary of Defense
Assoc	associate
ASSS	Air Staff Summary Sheet
Asst	assistant
Atch	attachment (s)
BMEWS	Ballistic Missile Early Warning System
BOB	Bureau of the Budget
Brief	briefing
Brig.	Brigadier
ca	circa, about
Calif	California
CAN	Canada
CAP	Coordinated Action Plan

Capt	captain
ch	chief
chmn	chairman
CIA	Central Intelligence Agency
Co	company
Col	colonel
Colo	Colorado
comdr	commander
compt	comptroller
Cong	Congress
CONUS	Continental United States
Corp	corporation
CPR	Chinese People's Republic
CSAF	Chief of Staff, United States Air Force
D.C.	District of Columbia
DCA	Defense Communications Agency (DOD)
DCP	Development Concept Paper
DCS	Deputy Chief of Staff
DDR&E	Director of Defense Research and Engineering
dep	deputy
depts	departments
dev	development
dir	director, directorate
div	division
DOD	Department of Defense
Dr.	doctor
DRM	Dual Role Minuteman
DSCS	Defense Satellite Communications System
DSDD	Defense Subsystem Development and Demonstration
EHF	extra high frequency
EOS	earth-to-orbit shuttle
et al	and others
ETR	Eastern Test Range
EX	except
FM	Financial Management, ASAF
FOBS	Fractional Orbit Bombardment System, Soviet
FY	fiscal year

Gen	general
gp	group
HASC	House of Representatives Armed Services Committee
HASP	High Altitude Surveillance Platform
Hist	history
HPD	Hard Point Defense
HQ	headquarters
HRS	Hard Rock Silo
Ibid.	ibidem, in the same place
ICBM	Intercontinental Ballistic Missile
IDCSP	Initial Defense Communications Satellite Program
Inc	incorporated
intvw	interview (s)
IR	Infrared
ISA	International Security Affairs
IT&T	International Telephone & Telegraph Corp.
JCS	Joint Chiefs of Staff
JCSM	JCS memorandum
Jt	joint
KSC	Kennedy Space Center
LASP	Low Altitude Surveillance Platform
LES	Lincoln Laboratories Experimental Satellite
Lt	lieutenant
ltr	letter
LWIR	long-wave infrared
Memo	memorandum
Mil	military
MilSatCom	Military Satellite Communications
M.I.T.	Massachusetts Institute of Technology
MODS	Minuteman Offensive-Defensive System
MOL	manned orbiting laboratory
MOU	memorandum of understanding
MR	memorandum for record
MSC	Manned Spacecraft Center

MSD	missile and space defense
MSFC	Marshall Space Flight Center
msg	message
mtg	meeting
MTTF	mean-time-to-failure, usually in months
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NCMC	NORAD Cheyenne Mountain Complex
nd	no date given
NF	no foreign dissemination
NIPP	National Intelligence Projections for Planning
NM	nautical mile (s)
NORAD	North American Air Defense Command
ODDR&E	Office, Director of Defense Research and Engineering
ofc	office
OOS	orbit-to-orbit shuttle
opns	operations
OSAF	Office, Secretary of the Air Force
OSD	Office, Secretary of Defense
OTH	over-the-horizon (radar)
p	page
PBD	program budget decision
PCD	program change decision
PCR	program change request
PEM	program element monitor
Pers	personnel
pp	pages
pt	part
RD	restricted data
R&D	research and development
RDA	Research, Development and Acquisition (Council), AFSC
RFP	requests for proposal
rprt	report

s/	signed by
SA	Systems Analysis
SAB	Scientific Advisory Board, USAF
SAC	Strategic Air Command
SAF	Secretary of the Air Force
SAMSO	Space and Missile Systems Organization, AFSC
SAR	Special Access Required, Classified Space Project
SCC	Space Defense Computational Center
SDP	Special Defense Program
SEA	Southeast Asia (Vietnam, Thailand, Laos, Cambodia)
SEC'y	secretary
SECDEF	Secretary of Defense
sess	session
SHF	super high frequency
SLBM	submarine-launched ballistic missile
SMD	system management directive
SOS-70	Surveillance of Objects in Space in the 1970's, AFSC study
SPADATS	Space Detection and Tracking System, DOD
SPASUR	Space and Surveillance Network, Navy
SPD	System Program Director
SPO	System Program Office
ST	Space Technology
STAG	Space Technology Advisory Group, USAF
STG	Space Task Group
stmt	statement
STRAT-70	Strategic Operations in the 1970's, USAF study
STS	Space Transportation System
subj	subject
sup	supplement
TACSAT	tactical satellite
TacSatCom	Tactical Satellite Communications (System)
TDP	techical development plan
TSEG	Tactical Satellite Executive Steering Group
UHF	ultra high frequency
UK	United Kingdom
USAF	United States Air Force
VEDATS	Vela Data Transmission System
VCSAF	Vice Chief of Staff, United States Air Force
vol	volume
wl	west longitude
Z	Zulu, Greenwich Mean Time